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H-1132

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. 10/796,175 Confirmation No. 3510

Inventor: ARAKAWA, H. et al.

Filed: March 10, 2004

For: REMOTE COPY SYSTEM

Group Art Unit: 2818

Examiner: Unassigned

Customer No. 24956

PETITION TO MAKE SPECIAL
UNDER 37 CFR §1.102(d) (MPEP §708.02(VIII))

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The Applicants petition the Commissioner to make the above-identified application special in accordance with 37 CFR §1.102(d). In support of this Petition, pursuant to MPEP § 708.02(VIII), Applicants state the following.

(A) REQUIRED FEE

This Petition is accompanied by the fee set forth in 37 CFR § 1.117(h). A Credit Card Payment Form in the amount of $130.00 accompanies this Petition in satisfaction of the fee. The Commissioner is hereby authorized to charge any additional

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payment due, or to credit any overpayment, to Deposit Account No. 50-1417.

(B) CLAIMS DIRECTED TO A SINGLE INVENTION

All the pending claims of the application, claims 1-12, are directed to a single invention. A Preliminary Amendment, in which claims 13-20 are canceled, has been filed with this Petition to Make Special. If the Office determines that all claims remaining in the application are not directed to a single invention, Applicant will make election without traverse as a prerequisite to the grant of special status.

The claimed invention is directed to a system for copying data between a plurality of storage systems. The system includes a first storage system coupled to a plurality of computers. The first storage system includes a first logical volume storing data received from the plurality of computers. The system also includes a second storage system coupled to the first storage system, which comprises a second logical volume storing copy data of data stored in the first logical volume. The first storage system assigns time information to write data received from the plurality of computers and sends the write data and the time information to the second storage system. The second storage system stores the write data

received from the first storage system in the second logical volume in an order based on the time information assigned to the write data.

Under an additional aspect, the system may include a third storage system having a third logical volume, which stores the copy data of the data stored in the first logical volume. The first storage system then stores write data received from the plurality of computers in the first logical volume and sends the write data received from the plurality of computers to the second storage system. The second storage system assigns time information to the write data received from the first storage system and sends the write data with the time information to the third storage system. The third storage system stores the write data received from the second storage system in the third logical volume in accordance with the time information assigned to the write data.

(C) PRE-EXMINATION SEARCH

A careful and thorough pre-examination search has been conducted, directed to the invention as claimed in claims 1-12 of the application. The pre-examination search was conducted in the following areas: Class 711, subclasses 112, 114, 147, and 154; and Class 714, subclasses 6 and 13. Additionally, a

computer database search was conducted on the USPTO systems EAST and WEST. A keyword search was conducted on the EAST system in Class 707, subclasses 10, 102, 201, 204, and 230; Class 709, subclasses 217 and 223; and Class 711, subclasses 162 and 202. Additionally, a literature search was also conducted on the Internet for relevant non-patent documents and a search for foreign patent documents was conducted on the ESPACENET and Delphion® databases.

(D) DOCUMENTS DEVELOPED BY THE PRE-EXAMINATION SEARCH

Of the documents reviewed during the search, those deemed to be most closely related to the subject matter encompassed by the claims are listed below. These documents were made of record in the present application by the Information Disclosure Statement filed September 9, 2004.

Patent No.	Inventor(s)
US 6,157,991	Arnon
US 6,260,124	Crockett et al.
US 6,353,878	Dunham
US 6,366,987	Tzelnic et al.
US 6,408,370	Yamamoto et al.
US 6,581,143	Gagne et al.
US 6,647,474	Yanai et al.
US 6,658,542	Beardsley et al.

Pub. Pat. Appl.	Inventor(s)
US 20030051111	Nakano et al.
US 20030177321	Watanabe
US 20030188116	Suzuki et al.
US 20040024975	Morishita et al.

Pub. Pat. Appl.	Inventor(s)
US 20040128442	Hinshaw et al.
US 20040148477	Cochran

Non-Patent Literature:
"Role of Backup in Data Recovery", http://www.storage.com

Additionally, the following documents were made of record in the present application by the Information Disclosure Statement filed March 10, 2004.

Patent No.	Inventor(s)
US 6,092,066	Ofek
US 6,209,002	Gagne et al.
US 6,665,781	Suzuki et al.

Pub. Pat. Appl.	Inventor(s)
EP 0 672 985	Kern et al.
EP 1 150 210	Tabuchi et al.

Because all of the above-listed documents are already of record in the present application, in accordance with MPEP § 708.02(VIII)(D), additional copies of these documents have not been submitted with this Petition.

(E) DETAILED DISCUSSION OF THE REFERENCES

A discussion of each the above-listed documents is set forth below, pointing out, with the particularity required by 37 CFR 1.111 (b) and (c), how the claimed subject matter is patentable over the teachings of the above-listed documents.

Arnon, US 6,157,991, discloses a system for asynchronously updating a mirror storage of a source device. A source storage system 6 does not overwrite any data that has not yet been committed to a target storage system 8. The source storage system 6 maintains a data structure that includes information indicating which units of information updated in the source storage system have not yet been committed to the target storage system 8. In one embodiment of the invention, this information is maintained for each logical track. A data structure can be implemented in any of a number of ways. For example, a table can be provided in the global memory 25, and can be accessed by the host bus controller 19 prior to executing any write command from the host CPU 1. When the host bus controller 19 determines that a command issued from the host CPU 1 is attempting to overwrite a logical track that has not yet been committed to the target storage system 8, the host bus controller prevents that write from occurring. (See, e.g., column 8, lines 26-47.) Thus, while Arnon discloses a system for asynchronously updating a mirror storage, Arnon does not teach or suggest a first storage system that assigns time information to write data received from the plurality of computers and sends the write

data and time information to a second storage system, and the second storage system stores the write data received from the first storage system in the second logical volume in an order based on the time information assigned to the write data. Nor does Arnon disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Crockett, et al., US 6,260,124, disclose a system for dynamically resynchronizing backup data that includes an update map and a progress queue. For resynchronization, once an update data record is represented in the progress queue, a comparison is made between the data record's read time-stamp (the time the data record was read from primary storage) and its write time-stamp (the time when a host originally sent the data record to the primary controller for writing). If the write time-stamp is earlier than the read time-stamp, the update will already be included in a static resynchronization. On the other hand, if the write time-stamp is later than the read time-stamp, this is a new update not included in the static resynchronization, and, thus, the dynamic resynchronization process applies it to the backup storage.

(See, e.g., column 3, lines 1-10.) Accordingly, while Crockett et al. teach a method for resynchronizing synchronous data backup, Crockett et al. fail to disclose a first or second storage system that assigns time information to write data for enabling data transfer even when a host computer does not apply a write time to the write data. Crockett et al. also fail to disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Dunham, US 6,353,878, and **Tzelnic, et al., US 6,366,987,** disclose similar systems for backing up data remotely in which the data is not backed up until a backup command is issued by a host 20. In response to a backup command from host 20, a primary data storage subsystem 21 accesses a primary directory 26 to find data of the physical storage unit specified by a backup command in order to initiate a process of copying data from a primary storage 27 to a secondary storage 29 of a secondary data storage subsystem 22. The primary data storage subsystem 21 creates an "instant snapshot copy" of the specified physical storage unit, and this instant snapshot copy is protected from modification by the host 20 while the

instant snapshot copy is being written to the secondary storage 29. It is possible for the secondary storage 29 to contain more than one version of backup data for the same physical storage unit. In order to distinguish between different versions of backup data for the same physical storage unit, the primary data storage subsystem 21 appends an identification tag to the backup data transmitted from the primary data storage subsystem to the secondary data storage subsystem 22. The tag, for example, is supplied by the host 20 in the backup command transmitted by the host to the primary data storage subsystem 21. The tag could also include a date-time stamp generated by the primary data storage subsystem. In the secondary data storage subsystem 22, the tag associated with each version of backup data is stored in a secondary directory 28, which further includes a record of a set of locations of the secondary storage 29 in which the version of backup data is stored. The tag associated with each version of backup data in the secondary storage 29 is used in a restore operation initiated by the backup software 24 in response to the user 23 or in response to a call from an application program executed by the host 20. (See, e.g., Dunham, column 5, line 28 - column 6, line 3.) Thus, Dunham and Tzelnic do not disclose the present invention, in which a

first storage system assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system stores the write data in an order based on the time information assigned to the write data. Additionally, Dunham and Tzelnic do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Yamamoto, et al., US 6,408,370, disclose a host computer that gives a write time to each write data record when it issues a request for write to a primary controller. When the primary controller receives the write data from the host computer, it reports the completion of the receipt to the host computer. Then, the primary controller sends the write data records and the write times to the secondary controller. At this time, the primary controller operates to send the write data records to the secondary controller in the sequence of the writing times. The secondary controller operates to store the write data received from the primary controller onto a non-volatile cache memory. This makes it possible to guarantee the write data without any I/O process of control information

to and from disks. The secondary controller can guarantee the write data up to a certain time by referring to the received write time. (See, e.g., column 2, line 56 - column 3, line 7). Thus, Yamamoto et al. do not teach the present invention, including, a first storage system assigning time information to write data received from a plurality of computers and sending the write data and the time information to a second storage system, and the second storage system storing the write data received from the first storage system in an order based on the time information assigned to the write data. Additionally, Yamamoto et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Gagne, et al., US 6,581,143, disclose a multiprocessor data processing system that includes a data storage facility wherein one program operates with data in one data storage device and a plurality of other programs, wherein each other program interacts with another data storage device. Multiple copies of the data from the one storage device are made on each of the additional data storage devices for operation with their corresponding programs. The interaction between these

devices includes defining a first buffer for each additional storage device on which a copy is to be made and a second buffer for each additional storage device and the one storage device. Data from the one storage device is copied to one of the additional data storage devices thereby to enable another program to interact with the data copy on the additional data storage device independently of the data and of the program being utilized with the one data storage device. Each change made by the one program to data on the one storage device and by the other program to the corresponding additional storage device is recorded in the first and second buffers, respectively. Upon completion of independent operation, the information in the corresponding first and second buffers can be combined to identify data to be copied from the one data storage device to one additional storage device thereby to enable the data to be copied so the data in the additional storage device replicates the data in the one data storage device. Thus, unlike the present invention, Gagne et al. do not disclose a first storage system that assigns time information to write data and sends the write data and the time information to a second storage system, and the second storage system stores the write data received from the first storage system in an order based on the time information

assigned to the write data. Additionally, Gagne et al. do not disclose a third storage system that stores write data received from a second storage system in accordance with time information assigned to the write data.

Yanai, et al., US 6,647,474, disclose a data storage system for controlling the transfer or copying of data from a primary data storage system to a secondary data storage system, independent of and without intervention from one or more host computers. The data mirroring or copying is performed asynchronously with input/output requests from a host computer. Accordingly, since data will not be immediately synchronized between the primary and secondary data storage systems, data integrity is maintained by maintaining an index or list of various criteria including a list of data which has not been mirrored or copied, data storage locations for which a reformat operation is pending, a list of invalid data storage device locations or tracks, whether a given device is ready, or whether a device is write-disabled. Information is included as to the time of the last operation so that the data may later be synchronized should an error be detected. Both the primary or secondary data storage systems maintain a table of the validity of data in the other storage system. The service processors in one embodiment

periodically scan the index table for write-pending indicator bits and invoke a copy task which copies the data from the primary data storage device to the secondary. In addition, one or more of the spare index or table bits 114, 116 may be utilized to store other data such as time stamp, etc. (See, e.g., column 7, line 16 - column 8, line 7.) However, Yanai et al. do not teach the present invention, wherein a first storage system assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system stores the write data received from the first storage system in an order based on the time information assigned to the write data. Additionally, Yanai et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Beardsley, et al., US 6,658,542, disclose a system and method for caching data. A processor receives data from a host to modify a track in a first storage device. The processor stores a copy of the modified data in a cache and indicates in a second storage device the tracks for which

there is modified data in cache. During data recovery operations, the processor processes the second storage device and data therein to determine the tracks for which there was modified data in cache. The processor then marks the determined tracks as failed to prevent data at the determined tracks in the first storage device from being returned in response to a read request until the failure is resolved. (See, e.g., Abstract.) Thus, Beardsley et al. do not teach the present invention, including a first storage system assigning time information to write data received from a plurality of computers and sending the write data and the time information to a second storage system, and the second storage system storing the write data in an order based on the time information assigned to the write data. Additionally, Beardsley et al. do not teach a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Nakano et al., US20030051111, disclose a remote copy control method and large area data storage system. Two data centers are connected using a synchronous transfer copy function, and one of the data centers is coupled with a third

data center disposed at a remote location by an asynchronous remote copying function. The order in which a storage sub-system located in the vicinity has received data from a host is consistently guaranteed, and the third data center holds the data. Further, each storage sub-system includes a function whereby, during normal operation, data can be exchanged and the data update state can be obtained by the storage sub-systems located in the two data centers that do not directly engage in data transmission. Thus, in Nakano, three or more data centers are interconnected by a transfer path along which data can be transmitted synchronously and asynchronously. Data update state management means is provided for each storage sub-system, and in order to cope with the occurrence of a disaster that can not be predicted, the update state management means appropriately monitors the data update state of a storage sub-system that is located in another data center, and transmits notification of the data update state of the storage sub-system to the others. Each of the storage sub-systems that do not directly engage in the transfer of data has a transfer state/bit map, and since, to ascertain how many times and at which location in a transfer block data has been updated, one storage sub-system transmits inquiries that the other storage sub-system responds to, a

function for monitoring and managing the state of data updating (remote copying) is taught by Nakano et al. However, Nakano et al. fail to teach the present invention, including a first storage system that assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system that stores the write data in an order based on the time information assigned to the write data. Additionally, Nakano et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Watanabe, US20030177321, discloses data synchronization of multiple remote storage devices after remote copy suspension. Each of the storage systems includes volumes for storing data, and the volumes are maintained in a mirrored condition. If there is an interruption in the transmission of data between volumes, for example, caused by a failure of one or the other of the storage volumes, or a failure of the interconnecting network, a time-stamped bitmap created at the primary storage system is stored in one of the secondary storage subsystems. These records are then used to

resynchronize the pair after the connection link is established. In the event that one member or the other of the pair fails, at the time of failure a record is made on a different storage volume of the status of the write operations to the failed storage volume. This record can then be used to resynchronize the storage volumes at a later time. (See, e.g., paragraph [0006].) Thus, Watanabe does not disclose the present invention, in which a first storage system assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system stores the write data in an order based on the time information assigned to the write data. Further, Watanabe does not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Suzuki et al., US20030188116, disclose a method and apparatus for managing backup and restoring among copy volumes in a storage system. The storage system includes a plurality of copy volumes, with each of the copy volumes originating from a single volume and configuring a pair with the single

volume. Each of the copy volumes is capable of being independently used. Under the managing method of Suzuki et al., when the volumes configuring each pair are used by separate applications, for each pair in a memory, an address is stored at which updating of data has been made in the volumes as updated-location-managing information. In case a copy volume configuring a first pair is to be restored to have the contents of a copy volume belonging to a second pair, pieces of the updated-location-managing information for each of the first and second pairs are obtained from memory. Differential information is generated by merging the pieces of updated-location-managing information obtained. The differential information is indicative of a difference in the pieces of updated-location-managing information between the copy volumes. The copy volume which is to be restored is reproduced to have the contents of the copy volume to be the source of restoring, by copying data designated by the differential information from the copy volume to be the source of restoring to the copy volume which is to be restored. (See, e.g., paragraph [0009].) Thus, Suzuki et al., do not teach the present invention, including a first storage system that assigns time information to write data received from a plurality of computers and sends the write data and the time

information to a second storage system, and a second storage system that stores the write data in an order based on the time information assigned to the write data. Additionally, Suzuki et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Morishita et al., US 20040024975, disclose a storage system for multi-site remote copy. A sequence number counted is included for recording the write order from a host. The transfer-target management information is information by which the order in which data will be transferred to a copy destination is managed in a copy source of asynchronous remote copy. Transfer-target management information is used as a queue header of a queue structure formed out of sequence management information entries. First, the storage system CPU 30 secures a sequence management information entry for data newly written. Next, when the write source of the data is the host, the sequence number of the written data is acquired from a sequence number counter. Alternatively, when the write source of the data is another storage system 2, the sequence number included in the received data is acquired. Then, the

CPU 30 writes the acquired sequence number into the secured sequence management information entry. When the write source of the data is the host, the CPU 30 updates the value of the sequence number counter after acquiring the sequence number. (See, e.g., paragraphs [0044]-[0047].) Thus, Morishita does not include a first storage system assigning time information to write data received from a plurality of computers, and sending the write data and the time information to a second storage system, so that the second storage system stores the write data in an order based on the time information. Additionally, Morishita et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Hinshaw et al., US20040128442, disclose a disk mirror architecture that may include a system manager, which may create a spare processing unit by redistributing data stored on a processing unit that is actively in use, among a subset of the plurality of other processing units. The system manager may redistribute the data by reassigning blocks in a distribution map. The system manager may also include a background task that performs the redistribution of the data.

The system manager may also monitor all processing units and redistribute data among the disks coupled to the processing units upon detecting a change in network topology. (See, e.g., paragraph [0012].) The distribution map stores a striping scheme for a table. The striping scheme may distribute the table across a plurality of disks or may stripe the table on one of the plurality of disks. (See, e.g., paragraph [0015].) Thus, the disclosure of Hinshaw et al. is not directed to the same subject matter as the present invention, and does not include a first storage system that assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system that stores the write data in an order based on the time information assigned to the write data. Furthermore, Hinshaw et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Cochran, US20040148477, discloses a method and system for providing logically consistent logical unit (LUN) backup snapshots within one or more data storage devices. Backup

logical units within a pool are continuously recycled, so that the least-recently-current backup logical unit is next synchronized and activated to receive mirror I/O requests. A trigger I/O request is provided to allow an application program running on a host computer to signal points within a stream of I/O requests that represent logically consistent states. The controller of a data storage device recognizes a special I/O request received from a host computer as a TRIGGER event, and inserts a corresponding TRIGGER message into a sequenced stream of I/O requests for a particular primary LUN of a primary LUN/backup LUN mirror pair. The TRIGGER message indicates to the data storage device controller that, when all I/O requests preceding the TRIGGER message are successfully executed on the primary LUN, the primary LUN will be in a logically consistent state. The TRIGGER message can be, in turn, inserted into the I/O request stream directed to the backup LUN, so that the backup LUN can also detect a logically consistent state. Thus, Cochran does not teach the present invention, and does not include a first storage system that assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system stores the write data in an order based on the time

information. Additionally, Cochran does not teach a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

"Role of Backup in Data Recovery", (http://www.storage.com) discusses data backup issues in general, and does not disclose or suggest the claimed invention.

Ofek, US 6,092,066, discloses a data processing system that includes redundant storage of data and that enables access to the data by multiple processes. A communications link interconnects first and second data processing systems, each being capable of independent operation and including a host computer and data storage facility that stores a data collection at predetermined locations in data blocks. During a normal operating mode, the second system mirrors the data in the first system data storage facility. The second system can operate in an independent operating mode by disabling transfers through the communications link. While communications are disabled, the first system records an identification of each data block that it alters in its data

storage facility. The second system records an identification of each data block in its data storage means that changes as a result of its operation. When the independent operation of the second system terminates, the communications link re-enables transfers. Data blocks with combined recorded identifications are copied from the first to the second system data storage facilities to reestablish the second data processing system data storage facility as a mirror of the first data processing system storage facility. (See, e.g., column 3, line 47 - column 4, line 5.) Thus, Ofek is directed to resynchronizing a mirroring copy system following a disablement of communications, and does not teach the present invention, in which a first storage system assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system stores the write data in an order based on the time information. Furthermore, Ofek does not teach a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Gagne et al., US 6,209,002, discloses a storage system in which data is transferred between a production site and a remote site. The production site includes a host and production storage facility. The remote site is a remote storage facility, including a first data store and a second data store wherein the first data store receives data from the production facility on a track-by-track basis. The host can issue a plurality of cascade commands to enable the definition of a plurality of track status tables for identifying each track in the first data store that the production facility changes. In addition, the host can establish first and second operating modes. In the first operating mode, the second data store receives data from the first data store according to the changes recorded in the track status tables. During the second operating mode data from the second data store is copied to the remote storage facility according to the changes recorded in the track status tables at the time the second mode is established. (See, e.g., column 2, line 65 - column 3, line 12.) Thus, Gagne et al. do not teach the present invention, including a first storage system that assigns time information to write data received from a plurality of computers and sends the write data and the time information to a second storage system, and the second storage system stores

the write data in an order based on the time information assigned to the write data. Additionally, Gagne et al. do not teach a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Suzuki et al., US 6,665,781, discloses a method for duplexing data in a storage unit system to carry out backup operation of data from a primary-side system having one or more primary-side control units to a secondary-side system having one or more secondary-side control units. Under the method, time information relating to a write time is added to a data of a write request. The information is stored in a cache memory in the primary-side control unit when there is a write request from a processing unit to the primary-side control unit. The stored write data and the time information is transmitted to the secondary-side control unit. The write data and the time information is stored to a cache memory in the secondary-side control unit. The time information stored in the cache memory in the secondary-side control unit is transmitted to another secondary-side control unit via a communication route connecting the secondary-side control units with each other. The time information of a first

secondary-side control unit received from a first primary-side control unit is compared with a time information transmitted from a second-secondary side control unit. An older time information is transmitted to the next secondary side control unit via the communication route. The older time information is circulated between the plural secondary side control units, and a data guarantee time is determined for guaranteeing duplexing of the write data between the plural secondary side control units. Thus, while Suzuki et al. disclose the use of time information, they do not disclose the present invention in which the second storage system stores write data in an order based on time information assigned to the write data. Furthermore, Suzuki et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Kern et al., EP 0 672 985, discloses a primary storage subsystem that is synchronized by a common timer, and a secondary system, remote from the primary processor, which shadows the data updates in sequence-consistent order such that the secondary site is available for disaster recovery purposes. Under the method of Kern, time-stamping of each

write I/O operation occurs in the primary storage subsystem. Write I/O operation record set information is written from the primary storage subsystem for each data update. Self-describing record sets are generated from the data updates and the respective record set information, such that the self describing record sets are sufficient to re-create a sequence of the write I/O operations. The self-describing record sets are grouped into interval groups based upon a predetermined interval threshold. A first consistency group is selected as that interval group of self-describing record sets having an earliest operational time stamp, with the individual data updates being ordered within the first consistency group based upon time sequences of the I/O write operations in the primary storage subsystem. Thus, Kern et al. disclose time-stamping of each write I/O operation in the primary storage subsystem, but Kern et al. do not teach the present invention in which the second storage system stores write data in an order based on time information assigned to the write data. Furthermore, Kern et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

Tabuchi et al., EP 1 150 210, discloses a method of duplicating data of a system which is provided with a first storage subsystem group comprising two or more storage subsystems and a second storage subsystem group comprising two or more storage subsystems which store copies of the data of the first storage subsystem group. The data written into each of the storage devices of the storage subsystems which belong to the first storage subsystem group are given serial numbers and times. The data is transferred to the storage subsystems which belong to the second storage subsystem group. The two or more data received by each of the storage subsystems which belong to the second storage subsystem group are arranged in sequence of the serial numbers, the oldest time is decided comparing the latest times given to each of the storage subsystems by the communication among the storage subsystems which belong to the second storage subsystem group, and the data with the times earlier than the decided oldest time are the objects of data writing into the storage devices of the storage subsystems. Thus, Tabuchi et al. use a decided oldest time for determining which data to store, and do not disclose the present invention, including a system in which the second storage system stores write data in an order based on time information assigned to the write data. Additionally, Tabuchi

et al. do not disclose a third storage system that stores write data received from a second storage system in a third logical volume in accordance with time information assigned to the write data.

CONCLUSION

The Applicants submit that the foregoing discussion demonstrates the patentability of the claimed invention over the closest-known prior art. Accordingly, the requirements of 37 CFR §1.102(d) having been satisfied, the Applicants request that this Petition to Make Special be granted and that the application be examined according to prescribed procedures set forth in MPEP §708.02 (VIII).

The Applicants prepared this Petition in order to satisfy the requirements of 37 C.F.R. §1.102(d) and MPEP §708.02 (VIII). The pre-examination search required by these sections was "directed to the invention as claimed in the application for which special status is requested." MPEP §708.02 (VIII). The search performed in support of this Petition is believed to be in full compliance with the requirements of MPEP §708.02 (VIII); however, Applicants make no representation that the search covered every conceivable search area that might contain relevant prior art. It is always possible that prior

art of greater relevance to the claims may exist. The Applicants urge the Examiner to conduct his or her own complete search of the prior art, and to thoroughly examine this application in view of the prior art cited above and any other prior art that may be located by the Examiner's independent search.

Further, while the Applicants have identified certain portions of each cited reference in order to satisfy the requirement for a "detailed discussion of the references, which discussion points out, with the particularly required by 37 C.F.R. §1.111(b) and (c), how the claimed subject matter is patentable over the references" (MPEP §708.02(VIII)), the Examiner should not limit review of these documents to the identified portions, but rather is urged to review and consider the entirety of each reference.

Respectfully submitted,
Colin D Barnitz
Reg No. 35,061
For: Daniel J. Stanger
Registration No. 32,846
Attorney for Applicants

MATTINGLY, STANGER & MALUR, P.C.
1800 Diagonal Rd., Suite 370
Alexandria, Virginia 22314
(703) 684-1120
Date: Dec. 7, 2004